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EXAMINER	
RODGERS, COLLEEN E	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 09/945,535	**Applicant(s)** AHN ET AL.	
	Examiner Colleen E. Rodgers	**Art Unit** 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,6-10,14,15,19-23,27-31,35-37,51,52,54-56 and 62* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6-10,14,15,19-23,27-31,35-37,51,52,54-56 and 62* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/8/08*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action responds to the Amendment filed 4 February 2008. By this amendment, no claims are amended, added or canceled. Claims 1, 2, 6-10, 14, 15, 19-23, 27-31, 35-37, 51, 52, 54-56 and 62 remain pending.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 8 February 2008 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because the patent literature included (crossed through on the accompanying IDS) is not prior art to this application. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFE 1.97(e). See MPEP § 609.05(a).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 6, 7, 14, 15, 19, 20, 51, 52, 56 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ma et al** (USPN 6,207,589) in view of **Park** (USPN 5,795,808) and **Yano et al** (USPN 5,810,923).

Regarding claim 1, **Ma et al** disclose a method of forming a gate oxide on a transistor body region, comprising:

evaporation depositing [see col. 2, lines 54-55] a substantially amorphous and substantially pure single metal layer [see col. 2, lines 65-67; see also col. 3, lines 53-55 and 60-62; finally, see col. 5, lines 65-66, wherein the trivalent metal content "is in the range of approximately 0 to 50%"] directly contacting a single crystal semiconductor portion of the body region **52** [see col. 2, lines 11-14, wherein the barrier layer is present in "some aspects of the invention," and therefore is absent in others], the metal being chosen from the group IVB elements of the periodic table, specifically zirconium; and

oxidizing the metal layer to form a metal oxide layer directly contacting the body region, wherein the metal oxide is amorphous [see col. 3, lines 1-4 and 44-56].

Ma et al do not disclose wherein the evaporation deposition method is electron beam evaporation at a temperature between 150 and 200°C; furthermore, **Ma et al** is silent as to the surface roughness or smoothness. **Park** teaches depositing a metal layer, specifically zirconium (as in both **Ma et al** and the instant claims), by either sputtering or electron beam deposition [see col. 4, lines 22-27]. It would have been obvious to one of ordinary skill in the art at the time of invention to use e-beam evaporation deposition because it has been held that simple substitution of one known method for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). While the deposition temperature disclosed by **Park** is slightly higher than claimed, these claims are *prima facie* obvious without a showing that the claimed

ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the deposition temperature provides unexpected results in the layer produced. One of ordinary skill in the art would be motivated to optimize the deposition temperature to provide for processing limitations, including reduction of heat loads and the prevention of damage to other elements of the device due to exposure to higher heat.

Furthermore, **Yano et al** teach evaporation deposition of a single metal layer [while $Zr_{1-x}R_xO_2$ is preferred, it is taught that x may be 0, thus a single metal layer; see the Abstract] and oxidizing the metal [see col. 9, lines 1-6] and teach that the surface roughness is up to 0.6 nm across the surface. **Yano et al** teach a preferred crystalline metal rather than an amorphous metal, but also teach that it is known to make the metal amorphous. Furthermore, the instant specification teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would look to one such as **Yano et al** to modify the teachings of **Ma et al** and **Park**, such that one of ordinary skill would expect, as per the teachings of **Yano et al**, that the processes of **Ma et al** and **Park** would yield a surface roughness as taught by **Yano et al**.

Regarding claim 2, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 1, furthermore wherein the metal layer is zirconium [see **Ma et al**, col. 2, line 67; see also **Park**, col. 4, line 25].

Regarding claim 6, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 1, furthermore wherein oxidizing the metal layer includes oxidizing at a temperature of approximately 400ºC [see **Yano et al**, col. 10, lines 1-8].

Regarding claim 7, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 1, furthermore wherein oxidizing the metal layer includes oxidizing with atomic oxygen [see **Yano et al**, col. 21, lines 35-36].

Regarding claims 14 and 51, **Ma et al** disclose a method of forming a transistor [see Figs. 12 and 13] and the transistor formed thereby, comprising:

forming first and second source/drain regions [not shown; see col. 5, lines 42-43];

forming a body region **52** between the first and second source/drain regions;

evaporation depositing [see col. 2, lines 54-55] a substantially amorphous and substantially pure single metal layer [see col. 2, lines 65-67; see also col. 3, lines 53-55 and 60-62; finally, see col. 5, lines 65-66, wherein the trivalent metal content "is in the range of approximately 0 to 50%"] directly contacting a single crystal semiconductor region of the body region [see col. 2, lines 11-14, wherein the barrier layer is present in "some aspects of the invention"], the metal being chosen from the group IVB elements of the periodic table, specifically zirconium; and

oxidizing the metal layer to form a metal oxide layer directly contacting the body region wherein the metal oxide layer is amorphous [see col. 3, lines 1-4 and 44-56]; and

coupling a gate to the metal oxide layer [see Fig. 13].

Ma et al do not disclose wherein the evaporation deposition method is electron beam evaporation at a temperature between 150 and 200ºC; furthermore, **Ma et al** is silent as to the surface roughness or smoothness. **Park** teaches depositing a metal layer, specifically zirconium (as in both **Ma et al** and the instant claims), by either sputtering or electron beam deposition [see col. 4, lines 22-27]. It would have been obvious to one of ordinary skill in the art at the time of invention to use e-beam evaporation deposition because it has been held that simple substitution of one known method for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). While the deposition temperature disclosed by **Park** is slightly higher than claimed, these claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the deposition temperature provides unexpected results in the layer produced. One of ordinary skill in the art would be motivated to optimize the deposition temperature to provide for processing limitations, including reduction of heat loads and the prevention of damage to other elements of the device due to exposure to higher heat.

Furthermore, **Yano et al** teach evaporation deposition of a single metal layer [while $Zr_{1-x}R_xO_2$ is preferred, it is taught that x may be 0, thus a single metal layer; see the Abstract] and oxidizing the metal [see col. 9, lines 1-6] and teach that the surface roughness is up to 0.6 nm across

the surface. **Yano et al** teach a preferred crystalline metal rather than an amorphous metal, but also teach that it is known to make the metal amorphous. Furthermore, the instant specification teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would look to one such as **Yano et al** to modify the teachings of **Ma et al** and **Park**, such that one of ordinary skill would expect, as per the teachings of **Yano et al**, that the processes of **Ma et al** and **Park** would yield a surface roughness as taught by **Yano et al**.

Regarding claims 15 and 52, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 14 and the transistor of claim 51, furthermore wherein the metal layer is zirconium [see **Ma et al**, col. 2, line 67; see also **Park**, col. 4, line 25].

Regarding claim 19, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 14, furthermore wherein oxidizing the metal layer includes oxidizing with atomic oxygen [see **Yano et al**, col. 21, lines 35-36].

Regarding claim 20, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 14, furthermore wherein oxidizing the metal layer includes oxidizing with atomic oxygen [see **Yano et al**, col. 21, lines 35-36].

Regarding claims 55 and 62, **Ma et al** disclose a method of forming a gate oxide on a transistor body region, comprising:

evaporation depositing [see col. 2, lines 54-55] a substantially amorphous and substantially pure single metal layer [see col. 2, lines 65-67; see also col. 3, lines 53-55 and 60-62; finally, see col. 5, lines 65-66, wherein the trivalent metal content "is in the range of approximately 0 to 50%"] directly

contacting the body region, the metal being chosen from the group IVB elements of the periodic table, specifically zirconium; and

oxidizing the metal layer to form a metal oxide layer directly contacting the body region, wherein the metal oxide layer is amorphous [see col. 2, lines 11-14, wherein the barrier layer is present in "some aspects of the invention"; see also see col. 3, lines 1-4 and 44-56].

Ma et al do not disclose wherein the evaporation deposition method is electron beam evaporation; furthermore, **Ma et al** is silent as to the surface roughness or smoothness. **Park** teaches depositing a metal layer, specifically zirconium (as in both **Ma et al** and the instant claims), by either sputtering or electron beam deposition [see col. 4, lines 22-27]. It would have been obvious to one of ordinary skill in the art at the time of invention to use e-beam evaporation deposition because it has been held that simple substitution of one known method for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Furthermore, **Yano et al** teach evaporation deposition of a single metal layer [while $Zr_{1-x}R_xO_2$ is preferred, it is taught that x may be 0, thus a single metal layer; see the Abstract] and oxidizing the metal [see col. 9, lines 1-6] and teach that the surface roughness is up to 0.6 nm across the surface. **Yano et al** teach a preferred crystalline metal rather than an amorphous metal, but also teach that it is known to make the metal amorphous. Furthermore, the instant specification teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would look to one such as **Yano et al** to modify the teachings of **Ma et al**

and **Park**, such that one of ordinary skill would expect, as per the teachings of **Yano et al**, that the processes of **Ma et al** and **Park** would yield a surface roughness as taught by **Yano et al**.

Regarding claim 56, the prior art of **Ma et al**, **Park** and **Yano et al** teach the method of claim 55. **Ma et al**, **Park** and **Yano et al** are silent as to the range of the conduction band offset. However, as the process steps are identical and there is no teaching as to modifying the process to achieve the specified range, it is considered to be a range of common use, and one of ordinary skill in the art would know how to optimize the process to achieve this range. See *In re Aller*, previously cited.

5. Claims 8-10, 21 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ma et al** (USPN 6,207,589) in view of **Park** (USPN 5,795,808) and **Yano et al** (USPN 5,810,923) as applied to claims 1, 2, 6, 7, 14, 15, 19, 20, 51, 52, 56 and 62 above, and further in view of **Moise et al** (USPN 6,211,035).

Regarding claims 8, 21 and 54, the prior art of **Ma et al**, **Park** and **Yano et al** teach the methods of claims 1, 14 and 51 as described above. None of **Ma et al**, **Park** and **Yano et al** teach oxidizing in a krypton/oxygen mixed plasma. **Ma et al** teach annealing in an oxygen plasma containing inert gases such as argon and nitrogen [see col. 6, lines 64-65]. **Moise et al** teach oxidizing a metal layer with inert gases such as argon and krypton [see col. 12, lines 23-24]. It would have been obvious to one of ordinary skill in the art at the time of invention to use krypton because it has been held that simple substitution of one known element for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Regarding claim 9, **Ma et al** disclose a method of forming a gate oxide on a transistor body region, comprising:

evaporation depositing [see col. 2, lines 54-55] a substantially amorphous and substantially pure single metal layer [see col. 2, lines 65-67; see also col. 3, lines 53-55 and 60-62; finally, see col. 5, lines 65-66, wherein the trivalent metal content "is in the range of approximately 0 to 50%"] directly contacting a single crystal semiconductor portion of the body region [see col. 2, lines 11-14, wherein the barrier layer is present in "some aspects of the invention"], the metal being chosen from the group IVB elements of the periodic table, specifically zirconium; and

oxidizing the metal layer to form a metal oxide layer directly contacting the body region [see col. 3, lines 1-4].

Ma et al do not disclose wherein the evaporation deposition method is electron beam evaporation at a temperature between 150 to 200ºC, nor that the metal layer is oxidized using a krypton/oxygen mixed plasma; furthermore, **Ma et al** is silent as to the surface roughness or smoothness. **Park** teaches depositing a metal layer, specifically zirconium (as in both **Ma et al** and the instant claims), by either sputtering or electron beam deposition [see col. 4, lines 22-27]. It would have been obvious to one of ordinary skill in the art at the time of invention to use e-beam evaporation deposition because it has been held that simple substitution of one known method for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). While the deposition temperature disclosed by **Park** is slightly higher than claimed, these claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective

variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the deposition temperature provides unexpected results in the layer produced. One of ordinary skill in the art would be motivated to optimize the deposition temperature to provide for processing limitations, including reduction of heat loads and the prevention of damage to other elements of the device due to exposure to higher heat.

Moise et al teach oxidizing a metal layer with inert gases such as argon and krypton [see col. 12, lines 23-24]. It would have been obvious to one of ordinary skill in the art at the time of invention to use krypton because it has been held that simple substitution of one known element for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Furthermore, **Yano et al** teach evaporation deposition of a single metal layer [while $Zr_{1-x}R_xO_2$ is preferred, it is taught that x may be 0, thus a single metal layer; see the Abstract] and oxidizing the metal [see col. 9, lines 1-6] and teach that the surface roughness is up to 0.6 nm across the surface. **Yano et al** teach a preferred crystalline metal rather than an amorphous metal, but also teach that it is known to make the metal amorphous. Furthermore, the instant specification teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would look to one such as **Yano et al** to modify the teachings of **Ma et al** and **Park**, such that one of ordinary skill would expect, as per the teachings of **Yano et al**, that the processes of **Ma et al** and **Park** would yield a surface roughness as taught by **Yano et al**.

Regarding claim 10, the prior art of **Ma et al**, **Park**, **Yano et al** and **Moise et al** teach the method of claim 9, furthermore wherein the metal layer is zirconium [see **Ma et al**, col. 2, line 67; see also **Park**, col. 4, line 25].

6. Claims 22, 23, 25, 27, 28, 30, 31, 33, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ma et al** (USPN 6,207,589) in view of **Park** (USPN 5,795,808) and **Yano et al** (USPN 5,810,923) as applied to claims 1, 2, 6, 7, 14, 15, 19, 20, 51, 52, 56 and 62 above, and further in view of **Maiti et al** (USPN 6,020,024) and in view of the admitted prior art (pages 1-4).

Regarding claims 22 and 30, **Ma et al** disclose a method of forming an information handling system comprising:

forming a processor;

forming a memory array, comprising:

a number of access transistors, comprising:

forming first and second source/drain regions [not shown in Figs. 12 and 13; see col. 5, lines 42-43];

forming a semiconductor body region **52** between the first and second source/drain regions [see Fig. 12];

evaporation depositing [see col. 2, lines 54-55] a substantially amorphous and substantially pure single metal layer [see col. 2, lines 65-67; see also col. 3, lines 53-55 and 60-62; finally, see col. 5, lines 65-66, wherein the trivalent metal content "is in the range of approximately 0 to 50%"] directly contacting the semiconductor body region [see col. 2, lines 11-14, wherein the barrier layer is present in "some aspects of

the invention"], the metal being chosen from the group IVB elements of the periodic table, specifically zirconium; and

oxidizing the metal layer to form a metal oxide layer directly contacting the body region [see col. 3, lines 1-4]; and

coupling a gate to the metal oxide layer [see Fig. 13].

Ma et al do not disclose wherein the evaporation deposition method is electron beam evaporation at a temperature between 150 to 200°C, nor the formation of word lines, source lines and bit lines; furthermore, **Ma et al** is silent as to the surface roughness or smoothness. **Park** teaches depositing a metal layer, specifically zirconium (as in both **Ma et al** and the instant claims), by either sputtering or electron beam deposition [see col. 4, lines 22-27]. It would have been obvious to one of ordinary skill in the art at the time of invention to use e-beam evaporation deposition because it has been held that simple substitution of one known method for another to obtain predictable results is obvious. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). While the deposition temperature disclosed by **Park** is slightly higher than claimed, these claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the deposition temperature provides unexpected results in the layer

produced. One of ordinary skill in the art would be motivated to optimize the deposition temperature to provide for processing limitations, including reduction of heat loads and the prevention of damage to other elements of the device due to exposure to higher heat.

Maiti et al teach that transistors formed of a metal oxide with a high-k metal oxide gate are commonly used for integrated circuits. The admitted prior art (pages 1-4) teaches that these devices are commonly used in integrated circuits, particularly for processor chips, mobile telephones and memory devices. These devices typically employ word lines, source lines bit lines and system busses.

Furthermore, **Yano et al** teach evaporation deposition of a single metal layer [while $Zr_{1-x}R_xO_2$ is preferred, it is taught that x may be 0, thus a single metal layer; see the Abstract] and oxidizing the metal [see col. 9, lines 1-6] and teach that the surface roughness is up to 0.6 nm across the surface. **Yano et al** teach a preferred crystalline metal rather than an amorphous metal, but also teach that it is known to make the metal amorphous. Furthermore, the instant specification teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would look to one such as **Yano et al** to modify the teachings of **Ma et al** and **Park**, such that one of ordinary skill would expect, as per the teachings of **Yano et al**, that the processes of **Ma et al** and **Park** would yield a surface roughness as taught by **Yano et al**.

Regarding claims 23 and 31, the prior art of **Ma et al**, **Park**, **Yano et al** and **Maiti et al** teach the method of claims 22 and 30, respectively, furthermore wherein the metal layer is zirconium [see **Ma et al**, col. 2, line 67; see also **Park**, col. 4, line 25].

Regarding claims 27 and 35, the prior art of **Ma et al**, **Park**, **Yano et al** and **Maiti et al** teach the method of claims 22 and 30, respectively, furthermore wherein oxidizing the metal layer includes oxidizing at a temperature of approximately 400°C [see **Yano et al**, col. 10, lines 1-8].

Regarding claims 28 and 36, the prior art of **Ma et al**, **Park**, **Yano et al** and **Maiti et al** teach the methods of claim 22 and 30, respectively, furthermore wherein oxidizing the metal layer includes oxidizing with atomic oxygen [see **Yano et al**, col. 21, lines 35-36].

7. Claims 29 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ma et al** (USPN 6,207,589) in view of **Park** (USPN 5,795,808), **Yano et al** (USPN 5,810,923), **Maiti et al** (USPN 6,020,024) as applied to claims 22, 23, 25, 27, 28, 30, 31, 33, 35 and 36 above, and further in view of **Moise et al** (USPN 6,211,035).

Regarding claims 29 and 37, the prior art of **Ma et al**, **Park**, **Yano et al** and **Maiti et al** teach the methods of claims 22 and 30 as described above. None of **Ma et al**, **Park**, **Yano et al** and **Maiti et al** teach oxidizing in a krypton/oxygen mixed plasma. **Ma et al** teach annealing in an oxygen plasma containing inert gases such as argon and nitrogen [see col. 6, lines 64-65]. **Moise et al** teach oxidizing a metal layer with inert gases such as argon and krypton [see col. 12, lines 23-24]. It would have been obvious to one of ordinary skill in the art at the time of invention to use krypton because **Moise et al** teaches that they are art-recognized equivalents.

Response to Arguments

8. Applicant's arguments filed 4 February 2008 have been fully considered but they are not persuasive.

With respect to the rejection of claims 1, 2, 6, 7, 14, 15, 19, 20, 51, 52, 56 and 62, on page 9 of the Remarks, Applicants allege that "Ma teaches the benefits of ***heavily*** doped deposition of a metal layer to be oxidized to form the gate dielectric of a transistor" [emphasis in the original], and furthermore alleges that the Examiner has been "repeatedly ignoring the extremely clear teaching of the cited reference." This argument has been addressed multiple times; while the Examiner concedes that **Ma et al** teach that a *preferable* metal film contains the trivalent metal dopant, **Ma et al** also include the scenario where the metal film is 0% doped, which results in an explicit teaching of the evaporation deposition of a single metal. A teaching of non-preference does not constitute a teaching away; furthermore, **Ma et al** certainly demonstrate that evaporation deposition of a single metal is known, if not preferred for the disclosure. The rejection stands.

Furthermore, on page 10 of the Remarks, Applicants allege that "Ma does not teach or suggest direct contact of dielectric to the channel region." The Examiner emphatically disagrees. It is well known in the art for gate dielectrics to directly contact the channel region of a semiconductor device; furthermore, **Ma et al** teach that an interfacial barrier layer is present in only some aspects of the invention. Therefore, the barrier layer is not required, and the exclusion of the barrier is covered by the disclosure of **Ma et al**.

On pages 10-11 of the Remarks, Applicants object to the characterization of sputtering and evaporation as equivalents. The Examiner points out that these methods are taught by **Park** to be equivalent methods, particularly in that they can both be employed to form the layer in question; furthermore, this objection is besides the point. The reference of **Park** was used to modify **Ma et al** in order to show that, while **Ma et al** teach the genus of evaporation deposition, Applicants' preferred species of evaporation deposition, specifically electron beam evaporation, is well known in the art for the purpose of depositing a single metal. Furthermore, while sputtering may cause a

"rough surface and crystal damage," it is only one of a finite number of methods for depositing a layer. It is well within the level of ordinary skill to decide which of the finite number of methods is best for the deposition result required. See, as cited above, *KSR International Co. v. Teleflex, Inc.,* 82 USPQ 1385 (2007).

Finally, on page 11 of the Remarks, Applicants allege that since **Yano et al** teach crystalline dielectrics, one of ordinary skill in the art would not be motivated to combine the references. However, as indicated above, the instant application teaches that the metal layer may be either amorphous or crystalline, with no criticality taught between the two types. Note that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to the rejection of claims 8-10, 21 and 54, Applicants allege that the combination with **Moise et al** fails to remedy the alleged deficiencies. However, the Examiner does not believe that the previously-cited references are deficient, as described above. Therefore, the rejection stands.

With respect to the rejection of claims 22, 23, 25, 27, 28, 30, 31, 33, 35 and 36, Applicants allege that the combination with **Maiti et al** fails to remedy the alleged deficiencies. However, the Examiner does not believe that the previously-cited references are deficient, as described above. Therefore, the rejection stands.

With respect to the rejection of claims 29 and 37, Applicants allege that the combinations with **Maiti et al** and **Moise et al** fail to remedy the alleged deficiencies. However, the Examiner does not believe that the previously-cited references are deficient, as described above. Therefore, the rejection stands.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-8603. The examiner can normally be reached on Monday through Friday, 8:00 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Carl Whitehead Jr./
Supervisory Patent Examiner, Art Unit 2813

/C. E. R./
Examiner, Art Unit 2813